REMARKS

Claims 1-4 and 6-7 are pending in this application. By this Amendment, Claims 5, 8 and 10 are canceled without prejudice or disclaimer, and Claims 1-4 and 6-7 are amended. Applicants respectfully submit that support for the claim amendments and new claim is provided in the originally filed application. Therefore, Applicants respectfully submit that no new matter is presented herein.

Personal Interview

Applicants appreciate and acknowledge the courtesies extended to the Applicants representative during the personal interview conducted November 8, 2005. The points discussed during the interview are incorporated herein below.

Claim Rejections – 35 U.S.C. §102

Claim 10 is rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,153,326 to Matsukawa et al. (Matsukawa). Claim 10 has been canceled without prejudice or disclaimer, thereby rendering the rejection moot.

Withdrawal of the rejection is respectfully requested.

Claim Rejections – 35 U.S.C. §103

Claims 1-4 and 6-8 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,464,700 to Steck et al. (Steck) in view of Matsukawa. Applicants respectfully traverse the rejection.

Claim 1 recites a polymer electrolyte fuel cell, including a seal formed from a liquid thermosetting sealing agent, and a lamination of separators and a membrane electrode assembly tightly sealed with the seal, said seal formed by applying the liquid thermosetting sealing agent into a gap formed between each separator and the

membrane electrode assembly, and then thermally curing the liquid thermosetting sealing agent at a temperature in a range of from 100 to 130°C over a period of from 1 to 5 hours, the liquid thermosetting sealing agent is based on a silicone series elastomer or isobutylene series elastomer, and a viscosity of the liquid thermosetting sealing agent at application is from 1,000 to 9,000 Pa.s, wherein upon curing, the seal has a permanent deformation of 60% or less when thermally aged at 90°C for 100 hours to retain the gap upon sealing.

Claim 7 recites a process for producing a polymer electrode fuel cell, including: a seal formed from a liquid thermosetting sealing agent, and a lamination of separators and a membrane electrode assembly tightly sealed with the seal, the seal formed by applying the liquid thermosetting agent into a gap formed between each separator and the membrane electrode assembly, the process including the following steps: a step for applying the liquid thermosetting sealing agent into the gap formed between each separator and the membrane electrode assembly at an application rate preset depending upon the viscosity of the liquid thermosetting sealing agent, and width and height of a resulting seal; thermally curing the liquid thermosetting sealing agent at a temperature in the range from 100 to 130°C over a period of from 1 to 5 hours; the liquid thermosetting sealing agent being based on a silicone series elastomer or isobutylene series elastomer, and the viscosity of the liquid thermosetting sealing agent at application is from 1,000 to 9,000 Pa.s; and the liquid thermosetting sealing agent is based on a silicone series elastomer or isobutylene series elastomer, and the viscosity of the liquid thermosetting sealing agent during application is from 1,000 to 9,000 Pa.s,

wherein upon curing, the seal has a permanent deformation of 60% or less when thermally aged at 90°C for 100 hours to retain the gap upon sealing.

As noted above and discussed during the November 8 interview, Claims 1 and 7 recite the structural feature of the seal having a permanent deformation, after curing, of 60% or less when thermally aged at 90°C for 100 hours to retain the gap formed between the corresponding separator and membrane electrode assembly upon sealing. As pointed out by the Examiner during the November 8 personal interview, the Office Action admits Steck fails to teach or suggest the structural feature of the gap between elements being retained upon sealing (*See* Figure 4 of Steck and the last paragraph on page 5 of the Office Action).

As also noted above and discussed during the November 8 interview, Claims 1 and 7 recite a liquid thermosetting sealing agent is based on a silicone series elastomer or isobutylene series elastomer, and has a viscosity at application in a range from 1,000 to 9,000 Pa.s. The liquid thermosetting sealing agent is applied into the gap formed between each separator and membrane electrode assembly, and then thermally cured at a temperature in the range of from 100 to 130°C, which in a condition where there is no chemical deterioration of the resultant seal occurring, over a period of from 1 to 5 hours, which is a condition where the seal formed after curing has a permanent deformation of not more than 60% when thermally aged at 90°C for 100 hours to obtain the seal and retain the gap formed between each separator and membrane electrode assembly. The polymer electrode assembly has a lamination assembly of separators and membrane electrode assemblies tightly sealed with the seal. Since the sealing agent is applied into a gap between a separator and membrane electrode assembly, even if the membrane

electrode assemblies each have a different thickness, the initial height of the seal may be followed up to the thickness of the membrane electrode assembly. This significantly reduces the difference in seal stress. See page 42, line 21 to page 45, line 2 and Figure 6 of the instant application.

When the seal as claimed and described, for example, on page 44, lines 10-20 of the instant application, is produced, the difference in stress can be suppressed small enough, wherein the fracture of the separators is suppressed (see page 44, line 21 to page 45, line 2). Such a reduction in the difference in seal stress according to the present invention makes it possible to apply various types of separators, such as a separator which is easily fractured and a separator made of swelling black carbon or of a metal, which is difficult to fracture due to bending.

Furthermore, as recited in the claims, the curing of the liquid thermosetting sealing agent is cured under rather unique conditions. Conventionally, the curing of such a sealing agent as used in the present invention is performed within one hour at a relatively high temperature, i.e., approximately 150°C. However, as recited in Claims 1 and 7, the liquid thermosetting sealing agent is thermally cured at a temperature in the range of 100 to 130°C, which is a condition where no chemical deterioration of the resultant seal occurs, over a period of from 1 to 5 hours, which is a condition where the seal formed after curing has a permanent deformation not exceeding 60% when thermally aged at 90°C for 100 hours. By selecting as curing conditions a relatively low temperature and a relatively long period, two benefits are obtained at the same time, i.e., avoid any chemical deterioration from occurring and the resulting seal has a low permanent deformation under aged conditions.

Applicants have reviewed Steck and Matsukawa and submit that Steck and Matsukawa, alone or in combination, fail to teach or suggest a seal having such a feature.

Regarding Steck, Applicants note the "gap" between the separators and membrane electrode assembly is not retained upon sealing as is clearly shown in Figures 4, 6 and 8.

Applicants further note the gasketing material (12 and 14) is disposed in the "gaps" (as characterized by the Office Action) between the separators (22 and 24) and the membrane electrode assembly (10, 30, 40, 50, 60 and 70). See Figures 2-12. However, the gasketing material disclosed by Steck is a thermoplastic resin that is used to form the seal of the fuel cell. Since a thermoplastic resin is used to form the seal, pressure must be applied simultaneously with the application of heat thereto. As such, one of ordinary skill in the art would readily and easily understand that the thermosetting resin used in the invention recited by Claims 1 and 7 is completely different than the thermoplastic resin disclosed by Steck.

Matsukawa discloses a silicone based thermosetting resin used for the formation of the seal of a fuel cell by injection molding. Matsuka discloses the silicone resin, which is the thermoset resin, is previously formed by injection molding. However, Matsuka does not teach or suggest a liquid thermoset sealing agent that has been cured over a period of 1 to over 1 to 5 hours. As explained above, curing the sealing agent over such a period, as in the invention recited by Claims 1 and 7, results in a seal having a permanent deformation that does not exceed 60% when thermally aged at 90°C for 100 hours.

As noted above, the unexpected results provided by the invention recited by Claims 1 and 7 is the lack of any chemical deterioration occurring, and the resulting seal having a low permanent deformation under recited aged conditions, both occurring simultaneously.

Furthermore, one of ordinary skill in the art would not look to Steck, alone or in combination with any other teachings, to provide or arrive at the present invention because Steck and the present invention involve totally different resins, i.e., thermoplastic versus thermoset.

To establish *prima facie* obviousness of a rejected claim, each and every feature of the rejected claim must be taught or at lest suggested by the applied art of record. See M.P.E.P. §2143.03. As explained above, Steck and Matsukawa, alone or in combination, do not teach or suggest the "gap" being retained between the separator and membrane electrode assembly. Claims 1 and 7 of the instant application recite such a feature. Moreover, one of ordinary skill in the art would not be motivated to combine the applied teachings of Steck and Matsukawa because the resin taught by Steck is totally different from and unsuitable for the industrial application that the claimed thermoset resin of Claims 1 and 7 is used. Regardless of the teachings of Matsukawa, one of ordinary skill in the art would not look to modify Steck according to the teachings of Matsukawa because Steck does not teach a resin that is suitable to be treated under the conditions taught by Matsukawa as the resin taught by Steck must undergo the treatments, i.e., application of pressure and heat, at the same time. The resin taught by Steck cannot be subjected to a pressure first, then a heat, as recited by Claims 1 and 7 as the resin taught by Steck is not suited for such treatments or conditions.

Therefore, for all of the above-discussed reasons, Applicants respectfully submit Claims 1 and 7 are not rendered obvious in view of Steck and Matsukawa and should be deemed allowable.

Claims 2-4 and 6 depend from Claim 1. It is respectfully submitted that these dependent claims be deemed allowable for at least the same reasons Claim 1 is allowable, as well as for the additional subject matter recited therein.

Withdrawal of the rejection is respectfully requested.

Conclusion

In view of the foregoing, reconsideration of the application, withdrawal of the outstanding rejections, allowance of Claims 1-4 and 6-7, and the prompt issuance of a Notice of Allowability are respectfully solicited.

Should the Examiner believe anything further is desirable in order to place this application in better condition for allowance, the Examiner is requested to contact the undersigned at the telephone number listed below.

In the event this paper is not considered to be timely filed, the Applicants respectfully petition for an appropriate extension of time. Any fees for such an extension, together with any additional fees that may be due with respect to this paper, may be charged to counsel's Deposit Account No. 01-2300, **referencing docket number 106145-00029**.

Respectfully submitted,
ARENT FOX PLLC

Murat Ozgu
Attorney for Applicants
Registration No. 44,275

Customer No. 004372
1050 Connecticut Avenue, NW, Suite 400
Washington, DC 20036-5339
Telephone: (202) 857-6000
CMM:MO/elp
Enclosure: Petition for Extension of Time